

Appendix C.1 Phorate Ecological Incidents

Table 1. Phorate Ecological Incidents, Organized by Type of Organism (Terrestrial or Aquatic), Crop, Year, and State.

PHORATE					
Year	State	Crop	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference) Mitigation or Rebuttal Comments
Terrestrial					
1981	CA	alfalfa	100 100	waterfowl sparrows blackbirds killdeer larks	Highly probable/Misapplication. On February 21, 1981 in Merced, CA, phorate, while being applied by aerial application to an alfalfa field, was inadvertently applied to an adjacent property. Due to a faulty dump mechanism, a large amount was also dumped into the waterway around the field. One hundred waterfowl and 100 other birds of various species died. Phorate residues were 54 ppm in teal and 31 ppm in coots. Phorate also was detected in water and vegetation within the property boundary. (B000150-006. California Department of Food and Agriculture, 1981).
1978	CA	alfalfa	195	ring billed gulls, cattle egrets, and curlews	Highly Probable/Misapplication. On Nov. 4, 1978, in Calipatria, CA, Thimet 10G was applied, contrary to label instructions, to an alfalfa field during irrigation (The label specifies not to apply phorate during irrigation). Two days after application, 195 bird carcasses were removed, including ring-billed gulls, cattle egrets, and curlews. Phorate was detected in all of the gulls. Phorate residues ranged from 0.05 ppm to 56 ppm. Regurgitated gizzard contents found at the exposure site contained nearly 100% crickets and 92.7 ppm phorate. Brain cholinesterase activity was inhibited by 76% to 96%. Cattle egrets had consumed various arthropods. Phorate residues in the egrets were 150 ppm (B000150-004. FWS, 1989; and USEPA, 1991).
1986	CA	barley	50-75	mallards and pintails	Highly Probable On November 4, 1986, 50 to 60 mallards and pintails were found dead in a field that had been planted in barley the previous summer in Tulelake, CA (FWS, 1989). Patuxent Wildlife Research Center analysis of crop contents for seven birds (5 mallards and two pintails) identified phorate in every crop. No evidence of misuse was found. (B000150-010. USEPA, 1991). Barley has been voluntarily withdrawn from American Cyanamide's label.
1985	VA	peanut	1	bald eagle	Possible. One debilitated bald eagle was found on the ground in a peanut field on May 23, 1985. Phorate, aldicarb, carbofuran, captan, and carboxin had been applied to the peanut field. No residue analyses were conducted. The eagle was treated with atropine, recovered, and released. (I004169-008)
1972	CA	sugar beet	25	ducks and blackneck stilts	Highly Probable. In June 1972, it was reported that 25 ducks and blackneck stilts died in the tail water area of a sugar beet field in Fresno, CA. Two days earlier, the field was treated with phorate. Residues were 90 ppm (I005754-010; B000150-014. Bischoff, 1973).

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Year	State	Crop	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference) Mitigation or Rebuttal Comments
1991	GA	winter wheat	8	bobwhite quail	Probable/Misapplication On January 5, 1991, what appeared to be eight bobwhite quail were found dead adjacent to a phorate-treated wheat field near Waynesboro, GA. Apparently, the field had been planted in late November, and the field had most likely been treated at planting. The formulation was not Thimet, but another formulation of phorate. Apparently during application, the equipment used had a tendency to clog because the soil was wet, and upon reaching the turn row, the applicator would lift the planter and whatever was clogged in the drill would spill out onto the ground. Examination of the crop and gizzard revealed wheat seed mixed with phorate. Phorate was determined to be the cause of death (B000150-016. USEPA, 1991). This incident occurred in the year following application. If the pesticide is deposited on the soil surface in piles because of misuse, degradation is likely to be slower than if the pesticide is incorporated into soil.
1989	SD	winter wheat	7 81 1 13 1	bald eagles Canada geese Snow Goose Waterfowl sharp-tailed grouse	Highly Probable On March 26, 1989, Thimet 20G killed birds on a winter wheat field in Hughes County, SD, 10 miles north of Pierre, that was treated on September 20, 1988 at the application rate of 1.2 oz/1000 foot row with a 10-inch row spacing. The incident report did not specify the application method but did report that the granules were incorporated. If label instructions were followed, the granules would have been applied in-furrow at planting. During late winter to early spring, a pond had formed in the wheat field from the thaw of the snow cover and from rain on March 16 and 17, 1989. On March 29, 1989, 70 Canada geese and other waterfowl were found dead around this temporary pond. A few days later, 12 Canada geese, ducks and a sharp-tailed grouse were found dead in a second small pond about one-third mile from the first pond. On March 19, eagles had been observed at one of these ponds feeding on dead geese. Seven bald eagles and possibly one golden eagle are believed to have been fatally poisoned by phorate in this manner. Phorate residues were measured in wheat at 2.2 ppm and at 0.025 ppm in the pond water samples. Phorate residues were also detected in the goose intestine found inside a bald eagle. (FWS, 1989a). See further discussion of the incident in the text of the RED chapter (B000150-015; B000150-012; B000151-001; I000805-006; South Dakota Department of Agriculture, 1989; FWS letter dated December 22, 1989).
1982	SD	winter wheat	38 4 9 6 7 1 1	mallards gadwalls wigeons pintails green-winged teal red-tailed hawk golden eagle	Highly Probable. In October 1982, an incident occurred from the use of phorate on wheat fields near Gettysburgh in Lyman County, SD. The birds were found dead in an intermittent wetland basin several days after a heavy rain. Residue analysis showed 7 ppb in the water and 14 ppb in the sediment. There is some potential for confusion regarding this incident and the incident that follows in Potter County, because I000804-008 represents simultaneous investigation of both incidents. (B000150-008; I000804-008; FWS, 1989)

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Year	State	Crop	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference) Mitigation or Rebuttal Comments
1982	SD	winter wheat	133 51 42 36 12 3 6 2 4	mallards pintails wigeons gadwall green-winged teal Canada geese marsh harriers red-tailed hawks great-horned owls	Highly Probable/Misuse. On October 18 and 20, 1982, 277 waterfowl and 12 raptors were found dead in two ponds in Reliance, Potter County, SD (FWS, 1989). Exposure apparently was from two wetland areas: an adjacent field treated with Thimet 15G in a band in the grass around a winter wheat field; and a second pond, also located in the middle of a winter wheat field, that had been entirely treated. Both ponds also had been exposed by a spill of Thimet 15G and Thimet 20G. A bag of Thimet 15G had been found floating in the pond, and the second pond had two bags in the vicinity. Heavy precipitation had been reported. Runoff was implicated for the second pond. There is some potential for confusion regarding this incident and the preceding incident in Lyman County, because I000804-008 represents simultaneous investigation of both incidents. (I000804-008; B000150-007. South Dakota Department of Agriculture 1982).
1982	SD	winter wheat	1	bald eagle	Highly Probable/Misuse. On December 5, 1982, in Potter County, SD, a bald eagle was found near the bird kill area cited in B000150-008. Various duck parts containing residues of 26 ppm phorate were found in the eagle's gastrointestinal tract. The eagle probably died from eating the remains of the duck carcass that had not been removed. (B000150-018. American Cyanamid, 1990).
1981	CA	winter wheat	2,000 2 several	blackbirds pheasant pigeons	Highly probable. On February 19, 1981 in Fresno County, CA, an incident involving phorate killed 2,000 blackbirds, two pheasants and several pigeons. Thimet 15 G was applied by air to a wheat field at the recommended rate nine days after reseeding. Standing water was observed in several irrigation ditches as a result of a rain storm about one week before application. American Cyanamid suspects that the birds consumed contaminated irrigation ditch water. Phorate residues were detected in the gizzards of the blackbirds at 24 ppm (B000150-005. California Fish and Game Department, 1981).
1996	KS	NR	3	swift fox	Highly Probable Five foxes were found dead in Kansas (Range W, Township 11 S) in June and July 1996. Phorate residues ranging from 23.5 to 58.9 ppm were found in the stomach contents of 3 of the 5 foxes. (I004756-001)
1993	CD	NR	11	Bald eagles	Highly Probable/Possible Misuse In December, 1993 11 bald eagles were poisoned and killed in the Ladner area (Lower Fraser Valley) of Vancouver, British Columbia, Canada. (An earlier report [I002486-002] listed 3 dead and 2 debilitated eagles) American Cyanamide speculates that the eagles became poisoned after feeding on dead or debilitated waterfowl. American Cyanamid suspects misuse because the kill occurred 8 months after the normal use season and because the residues consisted of mostly the parent compound (phorate) and not its sulfone or sulfoxide degradates. American Cyanamide temporarily withdrew the [Canadian?] registration of the Thimet 15 G formulation because of this incident. (I002486-002; I002679-001)

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Year	State	Crop	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference) Mitigation or Rebuttal Comments
1991	VA	NR	2	robins	Possible Two songbirds, including a robin, were found dead in a tilled corn field in Isle of Wight County, VA on April 5, 1991. The field had been treated with carbofuran (Furadan 15G) on April 4 and 5, 1991. This was under a field monitoring study being conducted at the time of observation. Based on residue analysis, it was determined that phorate probably caused the deaths, with residues of 7.9 ppm detected (0.3 ppm of carbofuran were also detected). How and where the birds had been exposed to phorate remains unknown (I000504-028. Southeastern Cooperative Wildlife Disease Study, 1991).
1989	WI	NR	10 55 1 1 2	Canada geese mallards barn owl skunk opossum	Misuse Incident occurred from April through June 1989 in Spring Green, WI. About 40 pounds of spilled or dumped phorate were reportedly discovered nearby. The Agency has no additional information on the cause of the incident. (B000150-013. FWS, 1989).
1987	CA	NR	1	red-tailed hawk	Possible. On January 16, 1987 a red-tailed hawk was found in a weakened condition in a “mud” field 9 miles from Dixon, Solano County, CA. The hawk subsequently died in a rehabilitation facility. A diagnosis of organophosphate poisoning was based on severe AChE inhibition and fecal residues of an unidentified OP. Use of phorate nearby was considered the most probable source of exposure. (B000150-009; USFWS).
1987	ID	NR	1	bald eagle	Highly Probable/Possible Misuse on February 16, 1987, in Jefferson County, ID, a bald eagle was found dead with a concentration of phorate in its stomach of 631 ppm. The mode of death is undetermined. American Cyanamid proposed that the eagle died after eating from a predator-control carcass poisoned with phorate because the stomach contents contained high amounts of fat and wavy white hair (B000150-011; American Cyanamid, 1990).
Aquatic					
1985	NE	sorghum	1000	fish	Possible. Phorate was applied in a sorghum field in Butler County, NE on May 8, 1985. Heavy rain fell five days later and hundreds of fish were killed nine days later. The water source for this pond was filtered overflow from a larger pond which had also suffered a fish kill at the same time. Terbufos (applied in-furrow to corn) and phorate (applied to sorghum) had recently been used in nearby fields above the pond. (I000598-001A; Nebraska Game and Parks Commission, 1985).
1976	AR	spill	90,000 1 1	fish raccoon deer	Accidental Spill. A truck carrying 4500 gallons of triester/phorate industrial waste developed a leak and spilled the entire load onto the shoulder of a road, down an embankment, and into a creek. 90,000 sunfish, bass, buffalo, and crappie were killed. Two cows were also killed. (B000300-55)

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Year	State	Crop	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference) Mitigation or Rebuttal Comments
1970	IL	corn	2000-3000 2 1	bluegill, bass, greengills, silver minnows, catfish, crappies fox squirrels water snake	Probable. Runoff from a 60 acre corn field into a 2 acre pond reportedly caused this kill. Residue analysis revealed phorate in the pond water at 9.7 to 32.3 ppb 15 days post application. Propachlor and 2,4-D were also applied to the field. (B000150-001; B000150-002)
1970	IL	corn	NR	fish	Probable. Runoff from a corn field into a nearby pond reportedly caused this fish kill. Residue analysis revealed phorate in the pond water at 12.1 ppb 37 days post application. Propachlor and atrazine were also applied to the field. (B000150-001; B000150-003)

Table 2. Phorate Aquatic Incidents Summary, Organized by Type of Incident (Discontinued Use Pattern, Misuse, Normal Use, etc.), Crop, Year, and State.

PHORATE					
Year	State	Crop	Number Affected	Species Affected	Certainty Index, Use Pattern, Residue and CHE Analysis, (Reference) Mitigation or Rebuttal Comments
The Following Incidents Occurred as a Result of Misuse¹					
1976	AR	spill	90,000 1 1	fish raccoon deer	Accidental Spill. A truck carrying 4500 gallons of triester/phorate industrial waste developed a leak and spilled the entire load onto the shoulder of a road, down an embankment, and into a creek. 90,000 sunfish, bass, buffalo, and crappie were killed. Two cows were also killed. (B000300-55)
The Following Incidents Occurred as a Result Normal Use or Casual Misapplication²					
1970	IL	corn	2000-3000 2 1	bluegill, bass, greengills, silver minnows, catfish, crappies fox squirrels water snake	Probable. Runoff from a 60 acre corn field into a 2 acre pond reportedly caused this kill. Residue analysis revealed phorate in the pond water at 9.7 to 32.3 ppb 15 days post application. Propachlor and 2,4-D were also applied to the field. (B000150-001; B000150-002)
1970	IL	corn	NR	fish	Probable. Runoff from a corn field into a nearby pond reportedly caused this fish kill. Residue analysis revealed phorate in the pond water at 12.1 ppb 37 days post application. Propachlor and atrazine were also applied to the field. (B000150-001; B000150-003)
The Following Incidents were not Associated with Specific Use Patterns and/or Causality was not Definitively Established					
1985	NE	sorghum	1000	fish	Possible. Phorate was applied in a sorghum field in Butler County, NE on May 8, 1985. Heavy rain fell five days later and hundreds of fish were killed nine days later. The water source for this pond was filtered overflow from a larger pond which had also suffered a fish kill at the same time. Terbufos (applied in-furrow to corn) and phorate (applied to sorghum) had recently been used in nearby fields above the pond. (I000598-001A; Nebraska Game and Parks Commission, 1985).

1. **Misuse** refers to deliberate application procedures that are prohibited by or contrary to label instructions. These include improper disposal of unused material; application in ways not specified by the label, etc.

2. **Casual Misapplication** refers to unintentional application mishaps that are difficult for growers to avoid and probably occur frequently in production agriculture. Examples include: clogging of equipment from application to wet soil. Misapplication can be differentiated from misuse in that they do not represent deliberate actions that are prohibited by current labeling.